



OEM Networking within a Converged Plantwide Ethernet Architecture

White Paper

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Rockwell Automation and Cisco Four Key Initiatives:

- **Common Technology View:**
A single scalable architecture, using open EtherNet/IP™ standard networking technologies, is paramount to enable the Industrial Internet of Things for achieving the flexibility, visibility and efficiency required in a competitive manufacturing environment.
- **Converged Plantwide Ethernet Architectures:**
Collection of tested and validated architectures developed by subject matter authorities at Cisco and Rockwell Automation. The content of CPwE is relevant to both Operational Technology (OT) and Information Technology (IT) disciplines and consists of documented architectures, best practices, guidance and configuration settings to help manufacturers with design and deployment of a scalable, robust, secure and future-ready plant-wide industrial network infrastructure.
- **Joint Product Collaboration:**
Stratix® 5950 Industrial Firewall, Stratix 5100 Wireless Access Point/Workgroup Bridge, and Stratix 5700, Stratix 5400 and Stratix 5410 Industrial Ethernet Switches, incorporating the best of Cisco and the best of Rockwell Automation.
- **People and Process Optimization:**
Education and services to facilitate Operational Technology (OT) and Information Technology (IT) convergence, assist with successful architecture deployment, and enable efficient operations that allow critical resources to focus on increasing innovation and productivity.

OEM Networking within a Converged Plantwide Ethernet Architecture

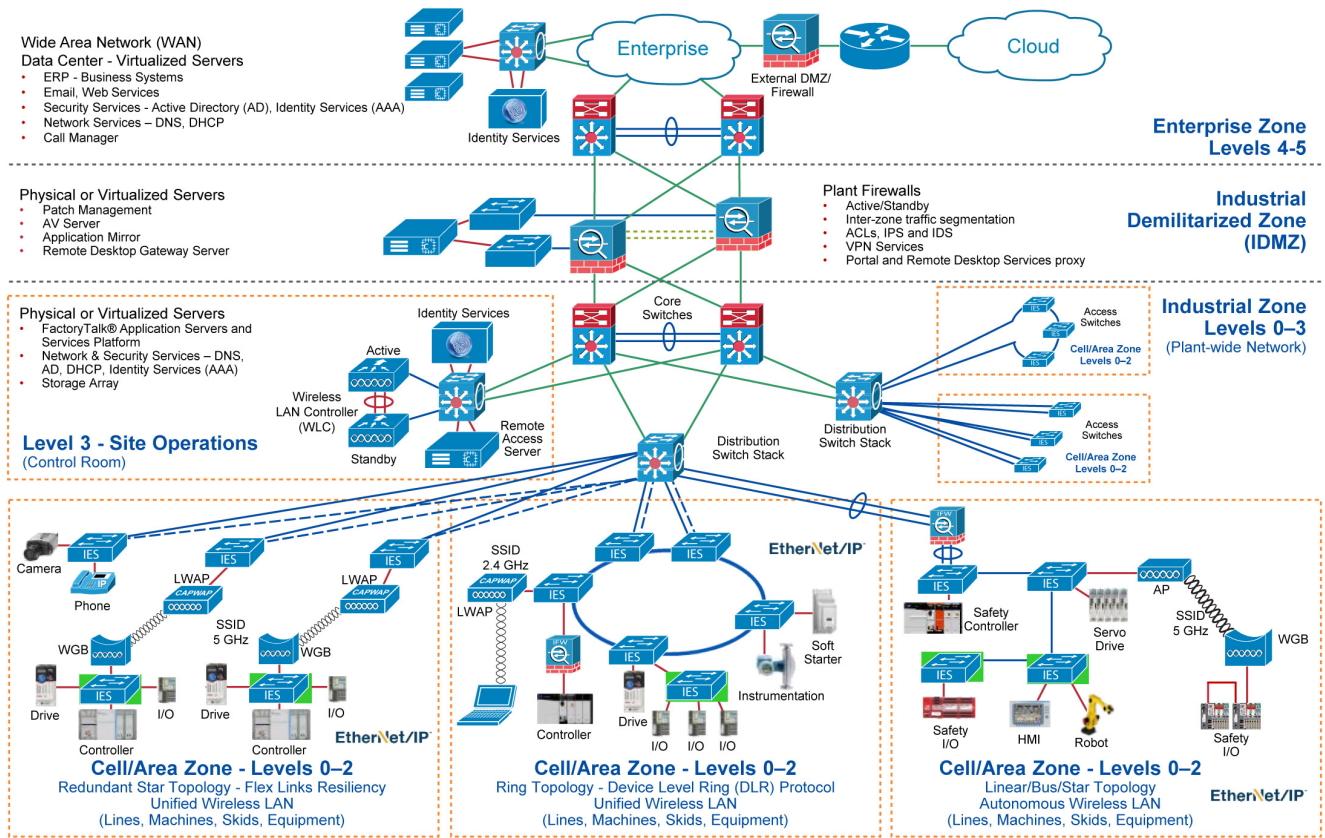
The prevailing trend in Industrial Automation and Control System (IACS) networking is the convergence of technology, specifically IACS operational technology (OT) with information technology (IT). Converged Plantwide Ethernet (CPwE) helps to enable IACS network technology convergence through the use of standard Ethernet, Internet Protocol (IP), network services, security services and EtherNet/IP connectivity. A converged IACS network technology helps to enable the Industrial Internet of Things (IIoT).

Whether an end user, OEM or system integrator, reliable and secure network infrastructure is critical for IACS design and deployment considerations. IACS applications requirements vary, so scalable and flexible choices in infrastructure devices are key to supporting the type of network and security services that are required for specific IACS applications. The choice of infrastructure devices is driven by the following business and technology aspects:

- Fully managed industrial Ethernet switches (IES) may provide too many reliability and security capabilities for specific IACS application criteria.
- Unmanaged IES reliability and security capabilities may be too limited for specific IACS application criteria.
- Lightly managed IES reliability and security capabilities may provide the right balance of business and technology aspects to meet specific IACS application criteria—for example, segmentation, data prioritization, resiliency and security.

OEM Networking within a Converged Plantwide Ethernet Architecture CRD (Cisco Reference Design), which is documented in the *OEM Networking within a Converged Plantwide Ethernet Architecture Design Guide*, outlines several use cases for designing and deploying lightly managed IES across OEM and plant-wide IACS applications. The CPwE OEM CRD is brought to market through a strategic alliance between Cisco Systems and Rockwell Automation.

Figure 1 CPwE Architectures with Lightly Managed IES at the Edge (highlighted in green)



Note

This release of the CPwE architecture focuses on EtherNet/IP, which uses the ODVA Common Industrial Protocol (CIP™) and is ready for the Industrial Internet of Things (IIoT). For more information on EtherNet/IP, see [odva.org](http://www.odva.org) at the following URL:

- <http://www.odva.org/Technology-Standards/EtherNet-IP/Overview>

Convergence-Ready OEM Applications

To help simplify seamless integration into the end user plant-wide network infrastructure, OEMs (skids, machines and equipment) should take into account the following design and deployment considerations when selecting network infrastructure devices such as IES:

- Manageability by an industrial Ethernet protocol that fully uses standard Ethernet and IP (such as EtherNet/IP) as the multi-discipline IIoT technology:
 - Common network infrastructure devices—optimized asset utilization
 - Scalable and future-ready—better sustainability

- IP addressing schema:
 - Who manages? End User (OT/IT) or OEM?
 - Address range (class), subnet, default gateway (routability)
 - Implementation conventions—static/dynamic, hardware/software configurable, network address translation (NAT) and domain name services (DNS)
- Use of Common Layer 2 and Layer 3 Network Services:
 - Segmentation, data prioritization
 - Topologies—Switch-level, device-level and hybrid
 - Availability—Loop prevention and redundant path topologies with resiliency protocols
- Use of Common Layer 1, Layer 2 and Layer 3 Security Services:
 - Physical access, port security, access control lists and application security (for example, FactoryTalk® Security)
 - Alignment with emerging IACS security standards such as IEC-62443 (formerly ISA 99) and NIST 800-82
- Time Synchronization Services:
 - IEEE 1588 Precision Time Protocol (PTP w/E2E)
 - CIP Sync applications—first fault, SOE and CIP Motion

CPwE OEM CRD

An IACS is deployed in a wide variety of discrete and process manufacturing industries such as automotive, pharmaceuticals, consumer packaged goods, pulp and paper, oil and gas, mining and energy. IACS applications are made up of multiple control and information disciplines such as continuous process, batch, discrete and hybrid combinations. One of the challenges facing manufacturers and OEMs is the industrial hardening of standard Ethernet and IP-converged IACS networking technologies to take advantage of the business benefits associated with the IIoT.

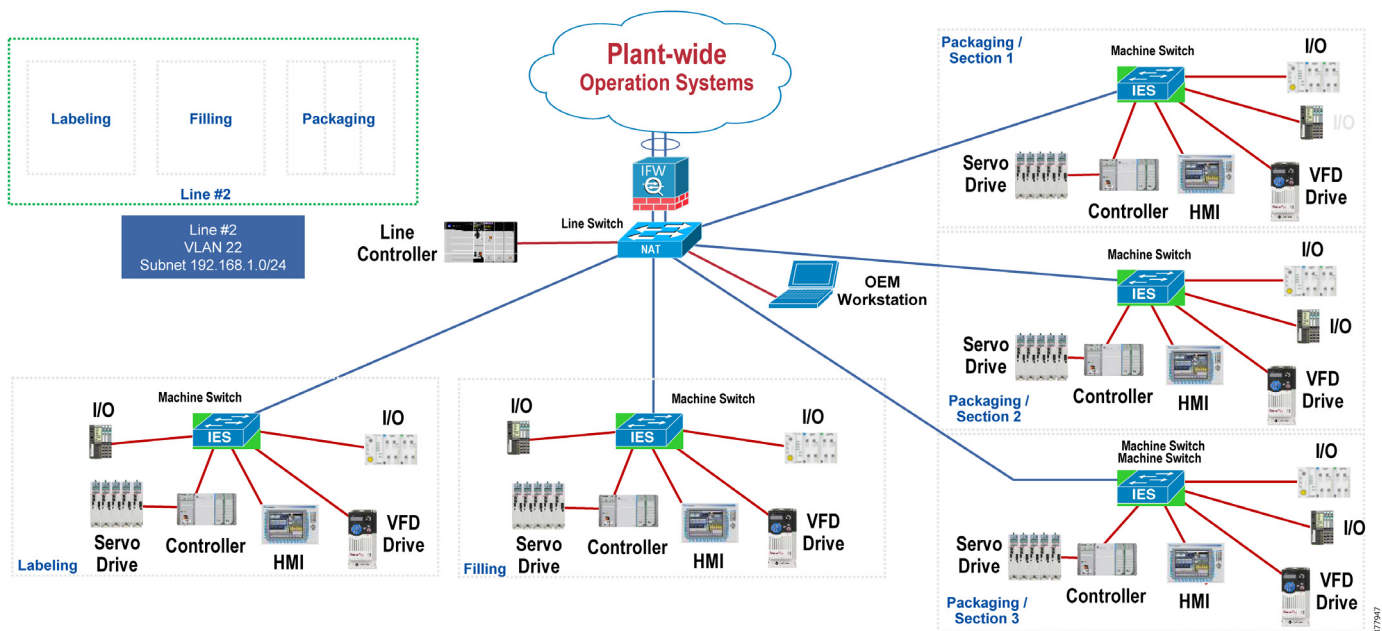
CPwE is the underlying architecture that provides standard network and security services for control and information disciplines, devices and equipment found in modern IACS applications. The CPwE architectures (Figure 1), through testing and validation by Cisco and Rockwell Automation, provide design and implementation guidance, test results and documented configuration settings that can help to achieve the real-time communication, reliability, scalability, security and resiliency requirements of modern IACS applications for manufacturers and OEMs.

The *OEM Networking within a Converged Plantwide Ethernet Architecture Design Guide* outlines the concepts, requirements and technology solutions for application use cases that were tested and documented by Cisco and Rockwell Automation to help support the application of lightly managed IES within plant-wide deployments of EtherNet/IP. The following is a summary of the CPwE OEM CRD:

- Plant-wide Zoning Overview:
 - Cell/Area Zone
 - OEM Sub-zoning
- Capability overview of lightly managed IES:
 - Allen-Bradley® Stratix® 2500
 - Cisco IE 1000

- Design and deployment considerations for lightly managed IES deployments:
 - Stand-alone lightly managed IES
 - Aggregated by fully managed IES
 - Aggregated by fully managed IES with NAT, segmentation and resiliency
- Application use cases (Figure 2):
 - Lightly managed IES for OEM applications (skids, machines, equipment)
 - Lightly managed IES at the edge of the plant-wide EtherNet/IP network

Figure 2 Representative Plant-wide lightly managed IES Deployments



Summary

CPwE is a collection of tested and validated architectures that are developed by subject matter authorities at Cisco and Rockwell Automation. The testing and validation follow the Cisco Validated Design (CVD) and Cisco Reference Design (CRD) methodologies.

The content of CPwE, which is relevant to both OT and IT disciplines, consists of documented architectures, best practices, guidance and configuration settings to help manufacturers and OEMs with design and deployment of a scalable, reliable, secure and future-ready plant-wide industrial network infrastructure. CPwE also helps manufacturers and OEMs achieve the benefits of cost reductions using proven designs that can help lead to quicker deployment and minimize risk in deploying new technology.

The *OEM Networking within a Converged Plantwide Ethernet Architecture Design Guide* outlines several use cases for designing and deploying lightly managed IES, while maintaining CPwE best practices, for OEM applications (skid, machine, equipment) and throughout the Cell/Area Zone within a plant-wide IACS

network infrastructure. The Design Guide highlights the key IACS application requirements, technology, and supporting design considerations to help with the successful design and deployment of these specific use cases within the framework of CPwE.

More information on CPwE Design and Implementation Guides can be found at the following URLs:

- Rockwell Automation site:
 - <http://www.rockwellautomation.com/global/products-technologies/network-technology/architectures.page?>
- Cisco site:
 - http://www.cisco.com/c/en/us/solutions/enterprise/design-zone-manufacturing/landing_ettf.html

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